4 NTSC Subiective Test Methodologies

4.1 Subjective Evaluation Overview

As discussed in 2.5.2, subjective evaluation of the NTSC audio/video clips is a multi-step process. as shown in Figure 4-1.

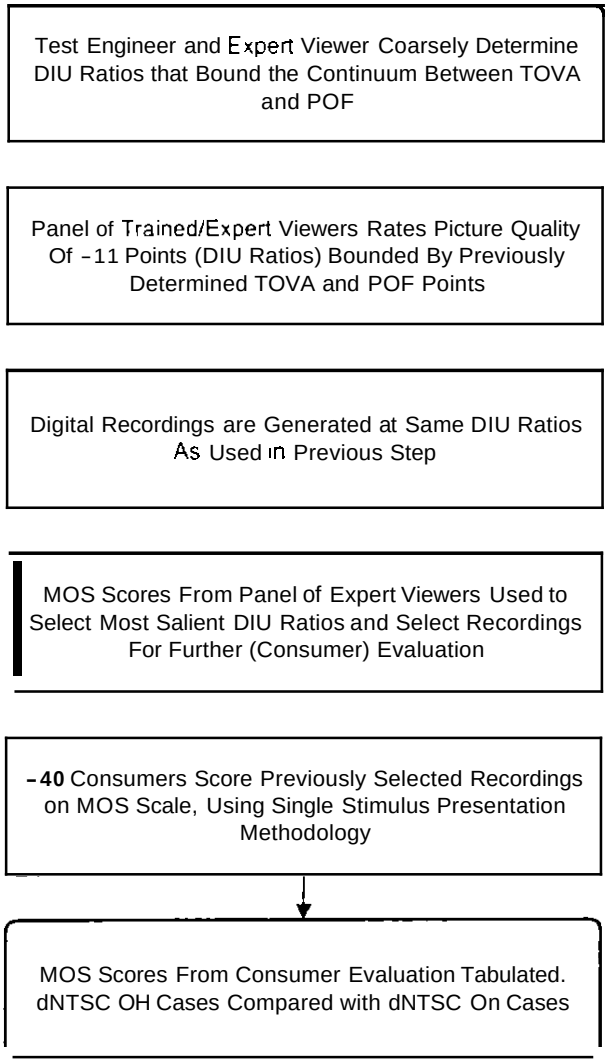


Figure 4-1 Flow Diagram of NTSC Test Methodology

4.2 Identifying Source Material

The following criteria shall be used to select appropriate audioivideo source material:

1) The material will be drawn from "real-world" TV programming.
2) The videotape source shall be at a quality level equal to that of a "master" tape. which would normally be used by a national broadcast network for program playout.
3) The complexity of the video material will be relatively low; simple/plain backgrounds are desirable.
4) The complexity of the audio will be relatively low; wherever possible. speech samples will be used.
5) The material will be selected to avoid any emotional reaction from test participants.
6) The material will be interesting enough to keep the test participant's attention
7) The material will not be overly "annoying", since participants were required to view the material repeatedly during the course of the subjective evaluation.

4.3 Identifying TOVA and POF

It is important to recognize that NTSC interference scenarios exist at varying levels of severitv. In some cases, interference may not be detectable, despite the presence of nearby stations on channels that might otherwise be expected to cause problems. In other cases, a nearby station on a certain channel may cause such severe interference that the desired NTSC station can not be watched – this point is often referred to as the Point of Failure (POF). Between these two points are several cases which consumers consider "watchable" to varying degrees. A crucial point along this continuum is a case known as the Threshold of Visibility or Audibility – hereafter referred to as 'TOVA'. At this point, the interference is just barely visible or audible to the consumer. The TOVA is of significant interest because it quantifies the onset of detectable interference.

Severity of interference is primarily influenced by the ratio of desired channel signal strength to undesired channel signal strengths. This relationship is traditionally referred to as the "DIU ratio" (i.e., Desired to Undesired Ratio), and is expressed in dB units. A positive DIU ratio indicates that the interfering signal has ***less*** power than the desired signal. A negative DIU ratio indicates that the interfering signal has ***more*** power than the desired signal. As the DIU ratio becomes "more negative", the interference severity increases. Threshold tests are designed to determine which DIU ratio corresponds to the TOVA point; They are designed to answer the question: 'What DIU ratio causes just noticeable interference to the picture or sound of a consumer TV?' Once this point is found, it may then be stated that this particular D/U ratio marks the onset of interference, and if the DIU ratio were to become more negative, the impairments could be expected to increase even further.

[8] There are manv other parameters that influence interference severity, including the received signal strength of the desired channel by itself. and the configuration of the interfering station. However, these factors are generally considered secondary to the dominant effect of the desired to undesired ratio.

As a first step in the subjective evaluation process. a test engineer and expert viewer will identify the TOVA and POF points described above for every receiver, in each interference condition (Note that dNTSC will always be *off* during this TOVA/POF identification phase). The TOVA and POF points will bound the test conditions to the region of interest (points outside of this region are either failed or subjectively unimpaired). Because these boundaries are expected to be somewhat coarse, it will be necessary to conduct a more formal evaluation of this region.

4.4 Identifying Salient D/U Ratios

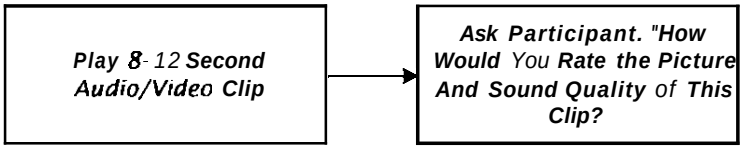
The region between TOVA and POF will be evaluated more formally using a panel of four expert viewers. The main objectives are to: 1)verify the previously identified TOVA and POF points 2) identify salient DIU ratios within the region between TOVA and POF. The D/U ratios identified by the panel of expert viewers will then undergo further subjective evaluation by consumers.

The panel of expert viewers will be presented with *2* audioivideo clips, back-to-back: the first clip is always unimpaired (free from interference), and the second clip is impaired (subject to interference at some DIU ratio). DIU ratios will be randomly selected by the test engmeer, so that viewers will not know what they are watching from trial to trial. The engineer will show viewers several clips covering a wide range of DIU ratios. Clips should range from "slightly impaired to "grossly impaired", and should cover all transmission points between these extremes in 2-3 dB increments. Viewers will simply be asked whether they saw a difference between the clean and impaired sample and if so, how large the difference is. Table 4-1 shows the rating scheme and numerical translation. Participants will rate clips individually. on a 5-point scale. For greater discrimination, viewers will be allowed to rate samples at intervals of 0.5.

Category	Numeric Translation
Identical	0
Slightly Different (TOVA)	1
Different	*2*
Extremely Different	3
Point of Failure (POF)	4

4.6 Subjective Evaluation by Consumers

The audio/video clips will then undergo extensive evaluation by consumers in a rigorous "subjective test" program, as described below.



Rating	Description of Rating (as provided to test subjects)	Numeric Translation for Analysis
Excellent	Overall quality of the picture and sound is superior I would watch this station all the time	5.0
Good	Overall quality of the picture and sound is good, although a slight impairment is obvious now and then. I would watch this station anyway, and find the transmission acceptable.	4.0
Fair	Overall quality of picture and sound is acceptable, though impairments are obvious. I would watch this station most of the time, especially if I was interested in the program.	3.0
Poor	Overall quality of picture and sound is marginally acceptable, and impairments are very obvious. I would watch this station only if I was motivated by its content	2.0
Bad	Overall quality ot picture and sound is unacceptable. I would turn this station off under most circumstances	1.0
Failure	Overall quality of picture and sound has failed and I would not watch under any circumstance	0.0

4.6.2 Experimental Design

Table 4-3 shows the experimental design of this study The entire experiment, including training. screening and testing will take approximately 1½ to 2 hours 240 samples will he presented to each participant fur rating

Table **4-3** Experimental Design

Interference Type	Receivers	D/U Ratios	dNTSC Off/On	A/V Clips Sub-Total
Co-channel	1-8	5	2	80
Lower 1st Adj	1-8	5	2	80
Upper 1st Adj	1-8	5	2	80
			Total Audio/Video Clips	**240**

4.6.3 Participants

Forty consumers (20 males and 20 females) will participate in this study, distributed between 16 and 46 years of age. Because this is a threshold test, we are interested in participants who are younger and more critical. Information concerning participants' age, gender and hearing and vision health will be collected.

In order to combat fatigue, participants will watch no more than 80 trials in a viewing session, followed by a 5-minute break. Participants will be given consent forms prior to participating and will be paid for their time after they complete the study.

Test Participant Training

In order for participants to become familiar with the impairments and software used to collect data, participants will be provided with a short training session. Training will include: (a) presenting participants with a range of impairments they will see and hear during the study. and ensuring that they can discern the impairment; and (b) teaching participants to properly use the software for registering their responses.

Test Participant Screening

In order to ensure the integrity of collected responses, it is critical to screen out participants who do not demonstrate an ability to detect impairments. Screening will be done in three ways.

First, ATTC will administer standard visual acuity (Snellen chart) and color blindness (Ishihara) tests to each participant prior to the start of the test session. Participants scoring worse than 20/30 visual acuity or exhibiting significant color blindness will not be included in the final test results.

Second, ATTC will design a pre-test screening procedure to determine whether participants can reliably discriminate between clean samples and those impaired samples that would be encountered throughout the test. Participants who reliably can detect impairments (at or above the 90% level) will be included in the test sample.

Third. after collecting data from all participants, a post-hoc statistical test will be conducted for each participant to ensure that individual participants' ratings correlate with group ratings. If an individual participant does not correlate at or above the 0.8 level with all other participants, their data will be excluded from the final test results.

5 dNTSC Compatibility with NTSC

5.1 dNTSC Compatibility with NTSC Upper Adjacent, Lower Adjacent, and Co-Channel Stations

Objectives

With the potential introduction of Dotcast's dNTSC system into the broadcast bands, there is a need to verify that the addition of dNTSC data does not significantly degrade NTSC to NTSC co-channel and adjacent channel interference situations.

This test series has one primary objective: Execute a series of laboratory tests to determine if the introduction of dNTSC data into the broadcast spectrum will affect **NTSC** to **NTSC** co-channel and adjacent channel interference.

Methodology

The relevant test methodologies are described in sections 2.5, 2.5.2 and **4.** These methodologies may be summarized as:

1. Generate specified adjacent channel and co-channel interference situations in the laboratory test bed
2. Gradually increase the power of the NTSC interferer until the test engineer and expert viewer coarsely identify the Threshold of Visibility or Audibility (TOVA)
3. Continue increasing the power of the NTSC interferer until the test engineer and expert viewer identify the Point of Failure (POF)
4. Present at least 11 D/U ratios between the previously identified TOVA and POF points to a panel of expertitrained viewers. **Ask** the panel to rate the quality of each audioivideo clip.
5. Generate at least 11 recordings at DIU ratios between the previously identified TOVA and POF points.
6. Select the most salient recordings (DIU ratios) based on the subjective scores from the panel of expert viewers.
7. Conduct a subjective test program using consumer (non-expert) subjects to score the quality of each audioivideo clip, using a single stimulus presentation methodology.
8. Compare the set of dNTSC-Off MOS scores to the set of dNTSC-On MOS scores.

Test Conditions

Table 5-1 lists the *primary* and *secondary* variables included in the co-channel and adjacent channel test suite. The *primary* test variable is always the presence or absence of dNTSC on the interfering channel. Secondary variables include interferer frequency, signal strength, receiver make/model. etc... The total number of recordings required to complete the test suite is computed by multiplying all test variables.

Table 5-1 dNTSC Compatibility with NTSC Adjacent Channels – Test Variables

Test Variables	Possible Values (enumerated)	# Of Possible Values
Desired Channel - Signal Type	NTSC	1
Desired Channel - Signal Strength	-50dBm	1
Undesired Channel - Signal Type	NTSC; dNTSC	2
Undesired Channel - Signal Strength	Variable	NA
Undesired Channel - Signal Frequency	Lower First; Upper First; Co-Channel	3
Signal Under Test	Video & Stereo	1
Measurement Type	Tape Recordings @ 10 D/U Levels	11
Receivers Under Test	Receivers 1 thru 8	8
	Total # Of Tape Recordings	528

Table 5-2 and Table 5-3 enumerate the conditions on a test-by-test basis (i.e. each row of each table is one test). ***Note*** *that each test* ***is*** *actually comprised of multiple* ***recordings*** (each recording *is* performed at a different D/U ratio, as previously described).

Table 5-2 dNTSC Compatibility with NTSC Co-Channels - Enumerated Test Conditions

Test #	Desired Channel			Undesired Channel			Signal Under Test	Type	RX
	Signal Type	Signal Strength (dBm)	Test Material Name	Signal Type	Signal Strength (dBm)	Signal Frequency			
3001	NTSC	-50	Bell Sound	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	1
3002	NTSC	-50	Bell Sound	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	1
3003	NTSC	-50	Ballet Scene	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	2
3004	NTSC	-50	Ballet Scene	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	2
3005	NTSC	-50	Cookie Monster	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	3
3006	NTSC	-50	Cookie Monster	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	3
3007	NTSC	-50	Letter T	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	4
3008	NTSC	-50	Letter T	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	4
3009	NTSC	-50	Maria	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	5
3010	NTSC	-50	Maria	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	5
3011	NTSC	-50	Mr Noodle	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	6
3012	NTSC	-50	Mr Noodle	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	6
3013	NTSC	-50	Alan Murray	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	7
3014	NTSC	-50	Alan Murray	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	7
3015	NTSC	-50	Gwen Intro	NTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	8
3016	NTSC	-50	Gwen Intro	dNTSC	Variable	Co-Channel (Precise Offset)	Video & Stereo	Subj	8

Table 5-3 dNTSC Compatibility with NTSC Adjacent Channels –Enumerated Test Conditions

#	Desired Channel			Undesired Channel			Signal Under Test	Type	RX
	Signal Type	Signal Strength	Test Material Name	Signal Type	Signal Strength	Signal Frequency			
3101	NTSC	-50	Bell Sound	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	1
3102	NTSC	-50	Bell Sound	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	1
3103	NTSC	-50	Ballet Scene	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	2
3104	NTSC	-50	Ballet Scene	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	2
3105	NTSC	-50	Cookie Monster	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	3
3106	NTSC	-50	Cookie Monster	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	3
3107	NTSC	-50	Letter T	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	4
3108	NTSC	-50	Letter T	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	4
3109	NTSC	-50	Maria	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	5
3110	NTSC	-50	Maria	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	5
3111	NTSC	-50	Mr Noodle	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	6
3112	NTSC	-50	Mr Noodle	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	6
3113	NTSC	-50	Alan Murray	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	7
3114	NTSC	-50	Alan Murray	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	7
3115	NTSC	-50	Gwen Intro	NTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	8
3116	NTSC	-50	Gwen Intro	dNTSC	Variable	Lower Adjacent	Video & Stereo	SUBJ	8
3117	NTSC	-50	Bell Sound	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	1
3118	NTSC	-50	Bell Sound	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	1
3119	NTSC	-50	Ballet Scene	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	2
3120	NTSC	-50	Ballet Scene	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	2
3121	NTSC	-50	Cookie Monster	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	3
3122	NTSC	-50	Cookie Monster	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	3
3123	NTSC	-50	Letter T	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	4
3124	NTSC	-50	Letter T	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	4
3125	NTSC	-50	Maria	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	5
3126	NTSC	-50	Maria	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	5
3127	NTSC	-50	Mr Noodle	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	6
3128	NTSC	-50	Mr Noodle	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	6

#	Desired Channel			Undesired Channel			Signal Under Test	Type	RX
	Signal Type	Signal Strength	Test Material Name	Signal Type	Signal Strength	Signal Frequency			
3129	NTSC	-50	Alan Murray	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	7
3130	NTSC	-50	Alan Murray	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	7
3131	NTSC	-50	Gwen Intro	NTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	8
3132	NTSC	-50	Gwen Intro	dNTSC	Variable	Upper Adjacent	Video & Stereo	SUBJ	8

Since co-channel and adjacent channel interference is generally considered to be most severe in the VHF band (due to both a crowded spectrum and the propagation characteristics of VHF), all co-channel and adjacent channel tests will be executed using VHF channel 12.

As previously discussed, the FCC has extensively employed frequency offsets to combat co-channel interference. Since this represents the normal state of operation for the U.S. broadcast service, all co-channel tests will be executed between two stations whose carrier frequencies are offset from one another by 10,010Hz.[9]

The desired signal shall have characteristics as shown in Table 5-4. The undesired signal shall have characteristics as shown in Table 5-5.

Table 5-4 Desired NTSC Signal Configuration

RF Characteristics		
Description	**Value**	**Unit**
Type	NTSC	
Channel	12	
Visual-Aural Ratio	20	%
Peak Power	-50	dBm

Video Characteristics	
Description	**Value**
Main Picture	Test dependent; See test grids

Audio Characteristics		
Description	**Value**	**Unit**
Type	BTSC Stereo	
Main Audio	Test dependent; See test grids	
Main Audio Processing	8182A Factory; See Appendix B	
SAP Audio Processing	NA	
Total Deviation (peak)	70	kHz
Pilot Injection	5	kHz
L+R plus L-R (peak)	50	kHz
SAP Injection	0 (off)	kHz
SAP Deviation (peak)	0 (off)	kHz

[9] Note that the FCC specifies frequency offsets of 10kHz +/- 1kHz. However. experience has shown that the optimal offset is actually 10,010Hz. Since this represents the *best* case for NTSC to NTSC interference, it is expected that this would also be the *worst* case for dNTSC; it is hypothesized that dNTSC impairments would be more readily apparent in these conditions.

Table 5-5 Undesired NTSC Signal Configuration

RF Characteristics		
Description	**Value**	**Unit**
Type	NTSC	
Channel*	11,12+,13	
Visual-Aural Ratio	20	%
Peak Power	Variable	
Video Characteristics		
Description	**Value**	
Main Picture	M16/Rotating Pyramids	
dNTSC Data Characteristics**		
Description	**Value**	**Unit**
Aural DDS Rate (Raw)	1.43	Mbps
Aural DDS Injection	25	%
Visual DDS Rate (Raw)	4.29	Mbps
Visual DDS Injection	-24	dB
Visual DDS Mod	128QAM	

Audio Characteristics		
Description	**Value**	**Unit**
Type	BTSC Stereo	
Main Audio	"Santana"	
Main Audio Processing	8182A Factory; See Appendix B	
SAP Audio	Silence	
SAP Audio Processing	NA	
Total Deviation (peak)	70	kHz
Pilot Injection	5	kHz
L+R plus L-R (peak)	50	kHz
SAP Injection	0 (off)	kHz
SAP Deviation (peak)	0 (off)	kHz

• A "+" or "-" next to the channel number indicates a positive or negative 10,010Hz frequency offset. The undesired signal may occupy any one of the listed broadcast channels. depending on the specific test conditions.

****In test conditions where dNTSC is specified as *off*, these parameters do not apply**

6 dNTSC Compatibility with DTV

6.1 dNTSC Compatibility with DTV Upper Adjacent, Lower Adjacent, and Co-Channel Stations

Objectives

This test series has one primary objective: Execute a series of laboratory tests to determine if the introduction of dNTSC data into the broadcast spectrum will affect **NTSC** into DTV co-channel and adjacent channel interference.

Methodology

An overview of the DTV test methodology was given in section 2.5.1. This methodology may he summarized as:

1. Generate specified adjacent channel NTSC into DTV interference scenarios in the laboratory test bed
2. Gradually increase the power of the adjacent channel interferer until a trained/expert observer identifies the Threshold of Visibility (TOV).
3. Repeat procedure a maximum of 7 times *(7* trials). The final test result is the statistical median of all trials.
4. Compare TOV in dNTSC-Off conditions to TOV in dNTSC-On conditions.

For all tests, the Threshold of Visibility (TOV) shall be defined as the Desired-to-Undesired ratio (DIU) which results in the onset of visible errors in the DTV picture. A DTV picture is considered to be "at TOV" when an expertitrained viewer observes at ***least*** one error within a 20 second observation window, over a period of ***three*** *consecutive* 20 second observation windows.

Several different NTSC into DTV co-channel interference scenarios will be simulated in the laboratory. In each case, the test bed will generate both a "desired DTV RF signal and an "undesired' NTSC or dNTSC RF signal. The complete RF signal spectrum will be coupled into six consumer DTV receivers via their antenna input ports, and the resultant picture and sound quality of each set will be evaluated under various co-channel and adjacent channel interference test conditions.

For each interference scenario generated by the test bed. the power level of the *desired* RF signal will be set to a fixed level. The power of the *undesired* RF signal will initially be set to a very low level. The picture and sound quality produced by the receiver under test will be monitored. The power level of the undesired signal will be increased (in small steps) until bit errors are observed in the received picture or sound quality. At this point, the power ratio between the desired and undesired signal (DIU ratio) will be noted.

This process will be repeated for each of the test conditions specified in Table 6-2. Note that in half the cases the undesired signal does *not* have dNTSC present; in the other half, dNTSC ***is*** present on the undesired signal. *The* ***presence*** *or* ***absence*** *of dNTSC on* ***the*** *undesired signal is the primary test variable.* All of the test conditions will be repeated for each of the six DTV receivers under test.

Once all TOVA points are recorded. the values may be separated into cases where the undesired signal had dNTSC *off* and cases where the undesired signal had dNTSC *On.* A comparison of these values will indicate whether dNTSC had any impact on the TOVA point. If there is no difference between TOVA with dNTSC *off* and TOVA with dNTSC *on.* then it may be concluded that dNTSC does not affect these particular interference scenarios. If there *is* a difference between TOVA with dNTSC *off* and TOVA with dNTSC *on.* then the magnitude of the difference will provide a measure of *how much* of an impact dNTSC has on co-channeliadjacent channel interference.

Test Conditions

Table 6-1 lists the *primary* and *secondary* variables included in the DTV test suite. The *primary* test variable is always the presence or absence of dNTSC on the interfering channel. Secondary variables include signal strength, receiver make/model, etc... The total number of viewing/listening trials required to complete the test suite is computed by multiplying all test variables.

Table 6-1 Summary of Test Variables (dNTSC Compatibility with DTV)

Test Variables	Possible Values (enumerated)	# Of Possible Values
Desired Channel - Signal Strength	Strong: Moderate; Weak	***3***
Undesired Channel - Signal Type	NTSC; dNTSC	2
Undesired Channel - Signal Strength	Variable	**NA**
Undesired Channel - Signal Frequency	Co-Channel. Lower Adj, Upper **Adj**	3
Measurement "Trials"	7 TOV Trials in Each Condition	7
Receivers Under Test	6 DTV Receivers	6
	Total # Of Viewing Trials	756

Table 6-2 and Table 6-3 enumerate the conditions described in Table 6-1 on a test-by-test basis (i.e. each row of the table is one test). Note that each test must be repeated for each of the six receivers.

Table 6-2 Enumerated Test Conditions (dNTSC Compatibility with DTV Co-Channels)

Test #	Desired Channel		Undesired Channel			Signal Under Test	Measurement Type
	Signal Type	Signal Strength	Signal Type	Signal Strength	Signal Frequency		
3301	DTV	Strong	NTSC	Variable	Co-channel (No Offset)	DTV Transport Stream	TOV
3302	DTV	Strong	dNTSC	Variable	Co-channel (No Offset)	DTV Transport Stream	TOV
3303	DTV	Moderate	NTSC	Variable	Co-channel (No Offset)	DTV Transport Stream	TOV
3304	DTV	Moderate	dNTSC	Variable	Co-channel (No Offset)	DTV Transport Stream	TOV
3305	DTV	Weak	NTSC	Variable	Co-channel (No Offset)	DTV Transport Stream	TOV
3306	DTV	Weak	dNTSC	Variable	Co-channel (No Offset)	DTV Transport Stream	TOV

Table 6-3 Enumerated Test Conditions (dNTSC Compatibility with DTV Adjacent Channels)

Test #	Desired Channel		Undesired Channel			Signal Under Test	Measurement Type
	Signal Type	Signal Strength	Signal Type	Signal Strength	Signal Frequency		
3401	DTV	Strong	NTSC	Variable	Lower Adjacent	DTV Transport Stream	TOV
3402	DTV	Strong	dNTSC	Variable	Lower Adjacent	DTV Transport Stream	TOV
3403	DTV	Moderate	NTSC	Variable	Lower Adjacent	DTV Transport Stream	TOV
3404	DTV	Moderate	dNTSC	Variable	Lower Adjacent	DTV Transport Stream	TOV
3405	DTV	Weak	NTSC	Variable	Lower Adjacent	DTV Transport Stream	TOV
3406	DTV	Weak	dNTSC	Variable	Lower Adjacent	DTV Transport Stream	TOV
3407	DTV	Strong	NTSC	Variable	Upper Adjacent	DTV Transport Stream	TOV
3408	DTV	Strong	dNTSC	Variable	Upper Adjacent	DTV Transport Stream	TOV
3409	DTV	Moderate	NTSC	Variable	Upper Adjacent	DTV Transport Stream	TOV
3410	DTV	Moderate	dNTSC	Variable	Upper Adjacent	DTV Transport Stream	TOV
3411	DTV	Weak	NTSC	Variable	Upper Adjacent	DTV Transport Stream	TOV
3412	DTV	Weak	dNTSC	Variable	Upper Adjacent	DTV Transport Stream	TOV

The desired signal shall have characteristics as shown in Table 6-4. The undesired signal shall have characteristics as shown in Table 6-5.

Table 6-4 Desired DTV Signal Configuration

RF Characteristics			Audio/Video Characteristics	
Description	**Value**	**Unit**	**Description**	**Value**
Type	ATSC 8-VSB		MPEG Transport Stream Name (see Appendix A for further details)	Zone Plate
Channel	23			
Average Power				
• "Strong"	-28	dBm		
• "Moderate"	-53	dBm		
• "Weak"	-68	dBm		

*In cases where the DTV signal is to be tested in conjunction with a lower first adjacent NTSC signal, the DTV signal will be offset in frequency, such that the DTV pilot is 5.082138MHz above the NTSC visual carrier frequency. This translates to a +22.697kHz offset from the nominal DTV channel frequency. This practice is consistent with the FCC rules as described in 73.622.

Table **6-5** Undesired NTSC Signal Configuration

RF Characteristics			Audio Characteristics	
Description	Value	Unit	Description	Value
Type	NTSC		Type	Mono
Channel	23		Main Audio	Silence
Visual-Aural Ratio	20	%	Total Deviation (peak)	0 kHz
Peak Power	Variable		Main Audio Processing	NA
dNTSC Data Characteristics*			Video Characteristics	
Description	Value	Unit	Description	Value
Aural DDS Rate (Raw)	1.43	Mbps	Picture	Rotating Pyramids
Aural DDS Injection	25	%		
Visual DDS Rate (Raw)	**4.29**	Mbps		
Visual DDS Injection	**-24**	dB		
Visual DDS Mod	128QAM			

Procedures

1) Turn the desired DTV and undesired NTSC signals completely off
2) Cycle the power of the DTV receiver (resets receiver state)
3) Preset the frequencies of all DTV and NTSC signals
4) Preset the power level of the desired channel
5) Preset the initial power level of the undesired channel
6) Preset dNTSC Off/On status
7) Re-cue and play NTSC video source material feeding undesired channel
8) Verify that at least 10 seconds have passed since the desired DTV and undesired NTSC signals were turned off
9) Turn DTV signal on
10) Wait 5 seconds
11) Turn NTSC/dNTSC signal on
12) Increase DIU ratio (i.e. undesired NTSC signal power) until Point of Failure (POF) is reached.
13) Step "back" 3dB (i.e. decrease undesired NTSC signal power level by 3dB)
14) Increase DIU (i.e. undesired signal power) in 0.25dB increments until expertitrained viewer observes at least one error in ***three*** *consecutive* ***twenty*** second *intervals*. Record this DIU ratio as Threshold of Visibility (TOV).
15) Repeat entire procedure for seven (7) trials *or* until the same numerical test result is achieved four (4) times![10]
16) Record the TOV test results for each of the trials and calculate the statistical median of all trials.

[10] In general, each test will be repeated 7 times (7 trials). However, if the same numerical test results is obtained at least 4 times, no further trials are necessary, because additional trials will not affect the *median* test result.

Presentation of Data

Each interference condition shall produce results from at least 4 and a maximum of 7 trials. where the result from each trial is a DIU ratio corresponding to TOV. The primary test result shall **be** the statistical median of all trials performed in a given interference condition.

7 Standard Measurement Methodologies

7.1 RF Measurements

7.1.1 NTSC Peak Power

An HP437B average power meter with a diode detector shall be used to measure the average NTSC power. The NTSC visual carrier shall be modulated with a black. The aural carrier shall be off. The conversion to peak NTSC power shall be made by adding a +2.65 dB calibration factor to the measured average NTSC power.

Setup

The measuring instrument shall be an HP437B average power meter with an RMS responding sensor, and will be configured as shown in Table 7.1

Table **7-1** Power **Meter** Configuration

Parameter	Description
Sensor Type	HP 8481D (diode detector)
Limit Checking	On
Low Limit	-70dBm
High Limit	-20dBm
Cal. Factor	98.7% at 250MHz (from sensor calibration certification)

horizontal blue lines are also depicted These lines are set on the oscilloscope to indicate *25%* negative amplitude modulation

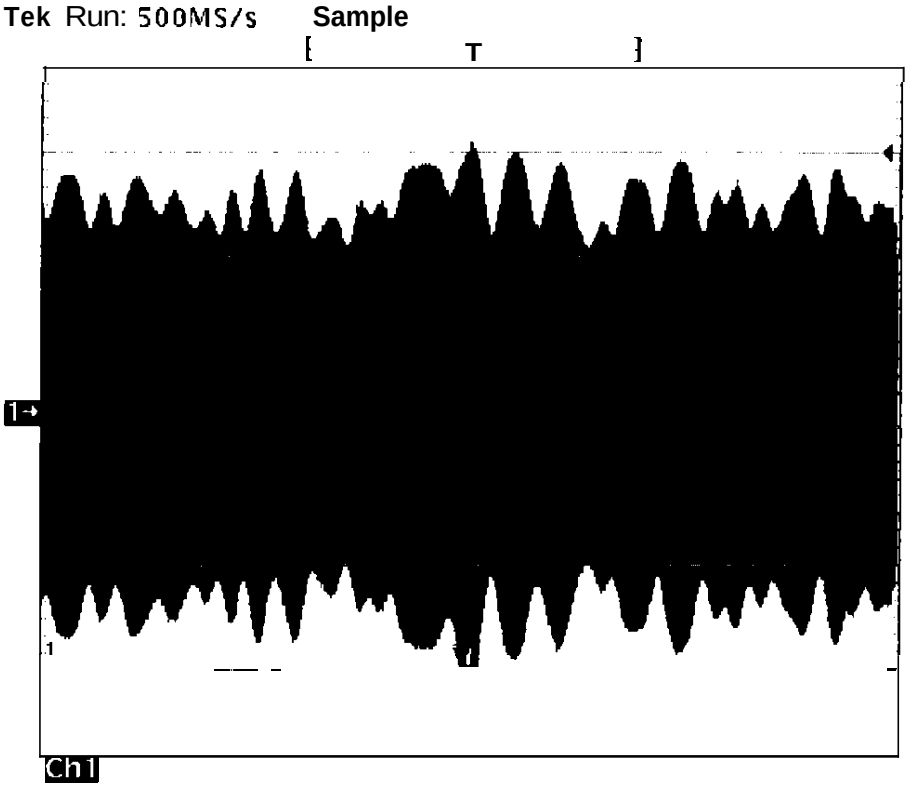


Figure 7-2 illustrates the modulated RF envelope in a "persistence" mode that accumulates oscilloscope traces over long periods of time. This mode is useful to identify maximum and minimum modulation peaks over long time intervals.

Setup and Procedure

A Tektronix TDS784D digital oscilloscope shall be used to observe the aural carrier in the time domain, with DDS data modulation enabled. The carrier shall be viewed in both instantaneous and "persistence" modes on the oscilloscope. The aural injection control on the data modulator shall be adjusted until the amplitude modulation falls within the 25% bounding **box** depicted on the oscilloscope (as illustrated in Figure 7.1 and Figure 7-2). It shall be verified that the modulation peaks do not extend significantly beyond this bounding **box** over a period of 60 seconds.

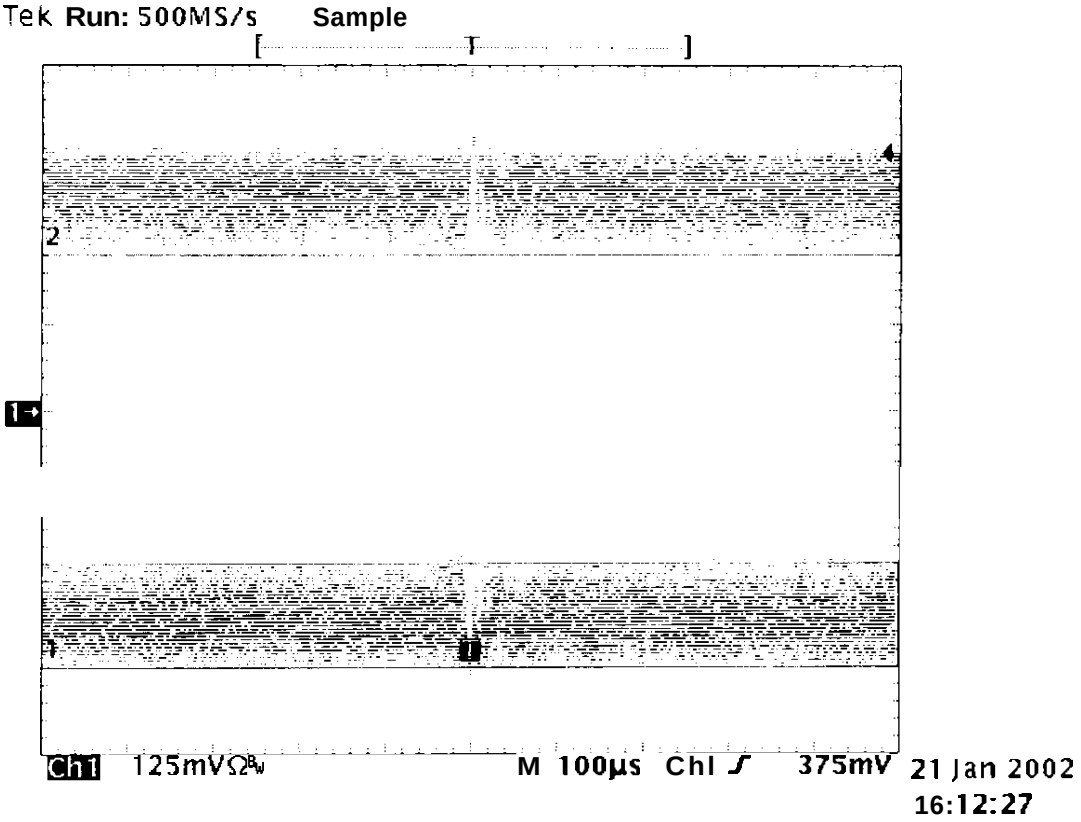


Figure 7-2 Modulation Depth Measurement of dNTSC Aural DDS Signal Accumulated Over Time

7.1.4 Visual-Aural Power Ratio

The aural to visual power ratio is determined by dividing the peak visual NTSC power (as determined in Section 7.1.1) by the average power of the unmodulated aural carrier (measured with the visual carrier off). The aural carrier average power is also measured using the HP437B average power meter.

A. Appendix A - Audio Processing:

Table A-1 and Table **A-2** enumerate the audio processor settings to he used for all subjective tests. These settings are hased on factory recommendations (as printed in the relevant operator's manual for each processor).

Table **A-1** Stereo Audio Processor Setup

Make: Orban Model: Optimod-TV Model 8182A	
Parameter Name	Parameter Setting
Loudness Control	On
Release Shape	**Exp**
Cornp	Operate
Limiter	Operate
Clipping	0
H-F Limiting	+3
Release Time	***3***
Bass Coupling	8
Gate Threshold	5
The processor is driven with nominally +4dBu/0VU audio signals; the processor input attenuators are adjusted such that the 'Total Master G/R" meter is nominally 0dB (+/-3dB)	

Table A-2 SAP **Audio** Processor Setup

Parameter Name	Parameter Setting
Loudness Control	On
Release Shape	**Exp**
Cornp	Operate
Limiter	Operate
Clipping	0
Release Time	**3**
Bass Coupling	8
Gate Threshold	***5***